

The Diamagnetic Zeeman Effect and the Exiton Structure in  
Cuprous Oxide Crystal

57-9-3/40

ments take place, which, even if the ordinary linear Zeeman effect is lacking, leads to the splitting up of the energy terms in the case of the exiton. The investigation of the magnetic splitting up in the  $\pi$ - and  $\sigma$ -components of the lines of the yellow series in Cu<sub>2</sub>O-crystal showed that with the lines of the series  $n = 3,4$  5,6 the diamagnetic quadratic Zeeman effect occurs, whereas the ordinary Zeeman effect is lacking. This proves that the narrow lines observed are caused by exitons and not by "admixture" centers. There are 15 Slavic references.

ASSOCIATION: Leningrad Physical-Technical Institute AN USSR (Leningradskiy fiziko-tehnicheskiy institut AN SSSR)

SUBMITTED: April 15, 1957

AVAILABLE: Library of Congress.

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L'vov, Ukr.SSR

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 Conference on Spectroscopy. Vol. 1: Molecular Spectroscopy)  
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 A. Ye., Candidate of Physical and Mathematical Sciences.

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GROSS, Ye.P.; ZAKHARCHENYA, B.P.; REYNOV, N.M.

Zeeman effect in the exciton spectra of cuprous oxide crystals.  
Fiz. sbor. no.3:38-39 '57. (NIEA II:8)

1. Fiziko-tehnicheskiy institut AN SSSR.  
(Copper oxides—Spectra) (Excitons) (Magnetooptics)

~~ZAKHARCHENYA, B.P.~~

57-9-36/40

AUTHOR: Gross, Ye.F., Zakharshenya, B.P., Pavinskiy, P.P.  
TITLE: Diamagnetic Exiton Levels and Cyclotron Resonance  
(Diamagnitnyye urovni eksitona i tsiklotronnyy rezonans)  
PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 9, pp. 2177 - 2180 (USSR)  
ABSTRACT: New phenomena are described. Nearer towards the series border, where diamagnetic displacement in the case of a lacking magnetic field attains the amount of the distance between the neighboring terms of the series, a spectrum, consisting of nearly equidistant lines, was observed at a distance between the lines of  $H = 29$  oooersted of the order of  $2 \text{ cm}^{-1}$ . This striped spectrum is continued also beyond the series boundary, where, with a lacking magnetic field, ( $H=0$ ) the through-going spectrum which corresponds to exiton dissociation is located. The farther one penetrates into the shortwave range, the less distinct does the structure of the spectrum become, and the spectral lines approach more closely to one another over a distance of  $1,6 \text{ cm}^{-1}$ . Hereafter their distribution becomes irregular. These lines are observed on the base of the through-going spectrum, where its intensity does not take a monotonous course but shows absorption maxima. The distance between the maxima is reduced as the short-wave part of the spectrum is approached. Thus, the spectrum

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Diamagnetic Exiton Levels and Cyclotron Resonance

here consists of absorption maxima upon which the aforementioned striped spectrum is impressed in form of a thin structure. The intensity of the absorption maxima becomes weaker to the extent as they shift towards the violet part of the spectrum, and coalesce with the limit of the continuous absorption. Investigations showed that the through-going exiton spectrum is a superposition of the absorption spectra corresponding to the exiton states at various  $\mu$ -values.  $\mu$  is the magnetic quantum number of the exiton. There is 1 figure and 2 Slavic references.

ASSOCIATION: Physical-Technical Institute AN USSR, Leningrad  
(Fiziko-tehnicheskiy institut AN SSSR, Leningrad)  
SUBMITTED: July 8, 1957  
AVAILABLE: Library of Congress

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ZAKHARCHENYA, B. P.

AUTHORS: Gross, Ye. F., Zakharchenya, B. P. 57-2-2/32

TITLE: Ionization of Excitons in a Cu<sub>2</sub>O Crystal by an Electric Field (Ionizat= siya eksitonov v kristalle Cu<sub>2</sub>O elektricheskim polem).

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp. 231-232 (USSR).

ABSTRACT: Reference is made to the great difference between experiment and theory, the latter proceeding from the correct assumption that the exciton in cuproud oxide is a Motta exciton. As this difference was still undetermined, the Stark effect was again investigated in a Cu<sub>2</sub>O crystal, where first of all the test conditions were perfected. The results obtained showed a good agreement with theory. First the deficiencies of the former tests are enumerated and it is shown that all these sources of error in the determinations of the field voltages in which a successive disappearance of the members of the exciton-series takes place may easily be removed when the observations in the domain investigated are carried out by measurement of the electric potential gradient with the aid of probes. The probes were put onto a small crystalline Cu<sub>2</sub>O plate by means of evaporation of gold in a vacuum. The probes had a distance of 1-2 mm from the silver base electrodes. The Stark effect was investigated at the exciton lines under conditions of cooling of the crystal to the tem=

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**Ionization of Excitons in a Cu<sub>2</sub>O Crystal by an Electric Field.** 57-2-2/32

perature of liquid nitrogen. A spectrograph with a dispersion of 10,5  $\text{Å/mm}$  was used for the observation of the spectrum. The consecutive disappearance of the members in the yellow exciton-series with the quantum numbers  $n = 4, 3, 2$  due to the ionization of the exciton by the electric field was distinctly observed. It became evident that a field voltage of 2,5 kV/cm is necessary for the ionization of the exciton from the state with  $n = 4$ . In the case of  $n = 3$ ,  $E = 9$  kV/cm and in the case of  $n = 2$ ,  $E = 29$  kV/cm. The values for the field voltages are highly different from those measured earlier and lie near those obtained by Samoilovich and Korenblit for the Stark effect. I. A. Polovnikova, Diplomantka in the State University, Leningrad, helped in the experiment. There are 5 references, 4 of which are Slavic.

ASSOCIATION. Technical Physics Institute AS USSR. Leningrad (Fiziko-tehnicheskiy institut AN SSSR. Leningrad).

SUBMITTED. August 22, 1957.

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Card 2/2      1. Crystals-Excitation    2. Crystals-Ionization

ZAKHAROVENY, B.P.

PLATE I FROM EDITION 20V/3140

Academija nauk Ukrainskoj SSR. Institut fiziki

Fotoelektricheskie i opticheskie svoistva v poluprovodnikakh  
troyogo perekroja s usrednenym po formule triebekha  
i opticheskaya poluprovodimost' v poluprovodnikakh. Klyev, 20-26  
noyabrya 1957 g. (Fotoelektricheskie i opticheskie svoistva v poluprovodnikakh  
i opticheskaya poluprovodimost' v poluprovodnikakh...) Klyev, 1959. No. 3 p.  
4,000 copies printed.

Additional Sponsoring Agency: Akademija nauk SSSR. Prezidium,  
Komissiya po poluprovodnikam.

No. of Publishing House: I. V. Klyans'ki Tech. Ed.: A. A. Mar'yanchuk;  
Rep. Ed.: V. Ye. Lashkevych. Academician, Ukrainian SSR, Academy  
of Sciences.

PURPOSE: This book is intended for scientists in the field of solid-  
conductor physics, solid-state spectroscopy, and semiconductor  
devices. The collection will be useful to advanced students in  
universities and institutes of higher technical training specializing in  
solid-state physics and technical application of solid-  
conductors.

CONTENTS: The collection contains reports and information bulletins  
(the latter are indicated by asterisks) read at the First All-  
Union Conference on Optical and Photoelectric Phenomena in Semi-  
conductors. A wide scope of problems in semiconductor physics  
and technology are considered: photoconductivity, photoelectro-  
and piezoelectric properties, photoelectric cells and  
solid-state forces, optical properties, photoelectric cells and  
photoresistor, the actions of hard and corpuscular radiations,  
the properties of thin film and complex semiconductor systems,  
etc. The author's notes, references, and discussions follow each article.  
Handbook. O. V. Zhilina, K. P. Talyzko, A. P. Lubchenko, and M. K.  
Shemdan. References and discussion follow each article.

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SOV/31-6-5-30/34

24(4), 24(6)

AUTHORS: Gross, Ye.F., Griyo, E. (Grillot), Zakharchenya, B.P. and  
Banssi-Griyo, M. (Bancie-Grillot).TITLE: The Effect of a Magnetic Field on the Blue Fluorescence and on the  
Absorption Lines of Some Pure Cadmium Sulphide Crystals at the  
Temperature of 4.2°K (Vliyanije magnitnogo polya na kinti sinoy  
fluorescentsii i na linii pogloshcheniya nekotorykh kristalov  
chistogo sernistogo kadmiya pri temperaturre 4.2°K)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 710-712 (U.S.S.R.)

ABSTRACT: Reports continuation of the work described in the preceding paper  
(see preceding abstract). The present work was carried out at the  
Physico-Technical Institute of the Ac. Sc. USSR in Leningrad. A CdS  
monocrystal prepared by sublimation (dimensions 4 mm x 2 mm x 10-100 µ)  
was placed between the poles of an electromagnet. A diffraction  
spectrograph with 1.7 Å/mm dispersion was used to record the fluorescence  
spectrum of the crystal excited by the 3650 Å line at 4.2°K. In a  
magnetic field of 28 000 Oe, oriented at right-angles to the optical  
axis of the crystal, the fluorescence lines at 4270, 4262 and 4261 Å  
exhibited Zeeman splitting into doublets (separations of 0.61, 0.8 and  
1.2-1.3 Å respectively, cf. Fig 1). The doublet components were  
polarized in the same way as the original lines, i.e. with the electric  
vector at right-angles to the optical axis of the crystal. No splitting  
was observed in magnetic field up to 28 000 Oe, oriented parallel to

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The Effect of a Magnetic Field on the Blue Fluorescence and on the Absorption Lines  
of Some Pure Cadmium Sulphide Crystals at the Temperature of 4.2°K

the optical axis of the crystal (Fig 2). The author studied also the effect of magnetic fields on the absorption lines of sublimated CdS monocrystals. They found that the 4869.1 Å is broadened from 1.62 to 2.24 Å by a field of 28 000 Oe (directed at right-angles to the optical axis of the crystal), indicating possible Zeeman splitting into a doublet. There are 4 references, 2 of which are French, 1 Soviet and 1 mixed (French and Russian).

SUBMITTED: December 31, 1958

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**240)** **ATTACH:** **Chancery, R.** **TITLE:** **The Fifth All-Union Conference on the Physics of Low Temperatures (5-ya Rossiyskaya sъm'ezhnaya po fizike zaryaz-** **SET/13-67-4-77**

**ABSTRACT:** This Conference took place from October 27 to November 1 in Tbilisi. It was organized by the *Georgian Institute of Mathematics and Mechanics* under Academy of Sciences USSR (Department of Physics-Mathematical Sciences of the Academy of Sciences, USSR), the Academy of Sciences USSR (Institute of Mathematics), Tbilisi State University (Institute of Mathematics), and the Tbilisi University (Institute of Mathematics). The Conference was attended by about 200 specialists from Tbilisi, Moscow, Leningrad, Kiev, Leningrad, Saratov, and other cities as well as by a number of young Chinese scientists. About 50 lectures were delivered according to research fields, which were divided according to research fields.

## • V. Various Questions.

STEADY STATE ANALYSIS OF THE BURKINABE POPULATION, P. 3.

the solvent suspensions. P. J. Kestens commented on the scope of the discussion. M. T. Shultz, T. S. Kosch and Dr. G. L. Salazar (BFR) presented two papers demonstrating by the methods of low-temperature calorimetry, thermal catalysis and visual observation of crystallization, the influence of dilution on the properties of compounds A, B, C, D, E, F, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, and on the mechanism of the photochemical precipitation by Quenochit, the latexes carried out at the same rankly similar as those (negative branch, as shown in Figure 1).

technician, *Nikitin*, gave a report on the measurements of the electric-ity limit of thin and initial delivery made at very low temperatures [1], and V. W. Karpov and G. I. Grivko spoke about attempts to find the expected change in the resonance resistance on polarons in copper wires [2]. G. S. Chubukov [3] and G. I. Grivko [4] of the Institute of Physics of the USSR Academy of Sciences (Moscow) and Institute of Physics of the USSR Academy of Sciences (Leningrad) carried out a theoretical investigation of the Gorkovskii effect in semiconductors. *Ivanov* investigated the electron and nuclear (*proton*) resonance in liquid-potassium hydride at helium temperatures. *P. A. Ivanov* spoke about the possibility of carrying out measurements of the orientation of  $\text{Co}^{+}$  and  $\text{Au}^{+}$  ions (in atoms) at extremely low temperatures. *A. M. Shchegolev* and *T. P. Grishina* [5] investigated the temperature dependence of the resonance cause crystals in the magnetic field of helium II. *V. V. Kabanov* and *V. V. Kabanova* observed the effect of magnetic field on the superconducting transition temperature. *V. P. Lukyanov* and *M. N. Malyshev* gave information on a scientific work of Soviet scientists in foreign countries. *S. V. Sosulin* spoke about the achievements of Soviet science in the field of the development of the physical properties of low-temperature superconductors. Academician *P. M. Kapitza* and the President of the Academy, *D. N. Grigor'ev* [6], the Academician *P. L. Sushkov* [7] closed the Conference. The 6th All-Union Conference on the Physics of low temperatures will be held in June, and July 1959 in the city of Frantsuzsk.

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89299

S/181/61/003/001/041/042  
B102/B204

26.2421

AUTHORS: Gross, Ye. F., Zakharchenya, B. P., and Konstantinov, O. V.

TITLE: Effect of the inversion of a magnetic field in the exciton absorption spectrum of a CdS crystal

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 305-308

TEXT: Studies of the effect of a magnetic field upon the absorption spectrum of CdS, on which the authors have made a report in Ref. 1, are intended to determine the exciton energy spectrum and its relation to the band structure in CdS. The experiments described here were carried out with 1 - 3 $\mu$  thick foils of CdS single crystals, whose optical axis  $\vec{A}$  was in the plane of the foil.  $\vec{H}$  was either parallel or perpendicular to  $\vec{A}$ . ( $\vec{A}$  is considered to be a vector, because the crystal has no inversion center). The crystals were cooled to 1.5°K and remained free from deformation. In the case of  $E \parallel \vec{A}$ , the exciton absorption lines with  $\lambda = 4853$ , 4813, and 4806 Å were weak and so narrow that the effect of the H-field upon them could be easily observed. The line with  $\lambda = 4813$  Å, on

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Effect of the inversion of a magnetic...

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which the inversion effect could be best observed, had a satellite line with  $\lambda = 4814 \text{ \AA}$ . At  $\vec{\lambda} \perp \vec{H}$ , the 4813-line split up into a doublet, whose center of mass was shifted toward higher energies relative to the original line. The weak 4814-line, whose origin is not quite clear, is also split up into a doublet; the components are weak and not so far apart as those of the main line. In the case of inversion of the field direction, the manner of splitting is considerably changed (shift of the main doublet  $\Delta\lambda = 0.4 \text{ \AA}$ ; intensity change). The essential change in the spectrum occurring when the field direction is inverted, consists in a shift of the Zeeman components and in a change of their intensity; the same effect is attained if the field is left as it is, and the crystal is rotated through  $180^\circ$ . Also the line with  $4853 \text{ \AA}$ , which is not split in the field, shows no effect of inversion. The line with  $4906 \text{ \AA}$  shows a complex splitting, and the inversion effect may be observed only with difficulty. The change of the absorption spectrum cannot be explained within the framework of the spectroscopy of an isolated atom, above all, because the effect is in contradiction to the invariance of the Schrödinger equation with respect to time reversal. The question is now

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examined as to what possibilities are left by the invariance of the quantum-mechanical equations with respect to the time reversal for excitons in the crystal. The invariance is formulated by means of the Onsager principle for the conduction tensor:  $\sigma_{\mu\nu}(\vec{k}, \omega, -\vec{H}) = \sigma_{\mu\nu}(-\vec{k}, \omega, \vec{H})$ .

Then the power absorbed per  $\text{cm}^3$  with a given  $\lambda$  and  $\vec{H}/H$  is  $W(\vec{H}) = \frac{1}{2} \sum_{\mu\nu} E_\mu E_\nu \text{Re} \sigma_{\mu\nu}(\vec{k}, \omega, \vec{H})$  and  $W(-\vec{H}) = \frac{1}{2} \sum_{\mu\nu} E_\mu E_\nu \text{Re} \sigma_{\mu\nu}(-\vec{k}, \omega, \vec{H})$ . Herefrom, the change in the absorption spectrum in the case of inversion of  $\vec{H}$  may be observed. In the presence of an inversion center in the absorbing medium, the effect would not be observable. The shift of the Zeeman components in the case of field inversion may be due to the following effect: The excitons excited by the electromagnetic wave move translatorily with  $\vec{v} = \hbar \vec{k}/\mu$  ( $\mu$  - effective exciton mass) and, in the presence of a constant magnetic field, they generate the field  $\vec{E} = \hbar [\vec{k}, \vec{H}] / C\mu$ . In a crystal without inversion center, the exciton state has a dipole moment  $\vec{d}$ , and to the energy of the exciton in the magnetic field,  $-(\vec{d}, \vec{E})$  is added additively.  $\vec{d}$  is parallel to  $\vec{A}$ , and the energy determining the shift

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Effect of the inversion of a magnetic...

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equals  $\Delta\epsilon \sim (\vec{A}, [\vec{k}, \vec{H}])$ . If any of these vectors are parallel,  $\Delta\epsilon = 0$  - and thus no effect may be observed, e.g., with  $\vec{k} \parallel \vec{H}$ . There are 1 figure and 6 references; 3 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Fiziko-tehnicheskiy institut AN SSSR imeni akad. A. F. Ioffe Leningrad (Institute of Physics and Technology of the AS USSR imeni Academician A. F. Ioffe, Leningrad)

SUBMITTED: August 24, 1960

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AGEKYAN, V. T.; GROSS, Ye. F.; ZAKHARCHENYA, D. P.; KAPLYANSKIY, A. A.

Piezomagnetooptical study of quadrupole exciton transition in  
 $Cu_2O$  crystals. *Fiz. tver. tela* 5 no.1:315-319 Ja '63.  
(MIRA 16:1)

1. Fiziko-tehnicheskiy institut imeni A. F. Ioffe AN SSSR,  
Leningrad i Leningradskiy gosudarstvennyy universitet.

(Magnetooptics) (Copper oxide crystals--Spectra)  
(Excitons)

GROSS, Ye.F.; ZAXHARCHENYA, B.P.; KANSKAYA, L.M.

Investigating the Stark effect of excitons in oriented single  
crystals of cuprous oxide. Fiz. tver. tela 3 no. 3:972-978  
Mr '61. (MIRA 14:5)

1. Fiziko-tehnicheskiy institut AN SSSR, Leningrad.  
(Stark effect) (Copper oxide Spectra)

GROSS, Ye.F.; ZHILICH, A.C.; ZAKHAROVENYA, B.P.; VARFALOMEYEV, A.V.

Magneto-optical studies of quadrupole exciton transitions in Cu<sub>2</sub>O crystals. Fiz.tver.tela 3 no.5:1445-1452 My '61. (MIRA 14:6)

1. Fiziko-tehnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.  
(Excitons) (Cuprous oxide--Magnetic properties) (Crystal lattices)

29693  
S/181/61/C03/010/019/036  
B104/B108

24,2100 (147,1164,1482)

AUTHORS: Gross, Ye. F., Zakharchenya, B. P., and Razbirin, B. S.

TITLE: Magneto-optical effects in the absorption spectrum of a cadmium-sulfide crystal

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3083 - 3091

TEXT: The Zeeman displacement of the two groups of absorption lines of cadmium-sulfide crystals was investigated (4889 - 4860 Å; 4860 - 4660 Å). Experiments were made in magnetic fields of up to 35,000 oe at temperatures of 4.2 and 1.3 K. The long-wave group was investigated with the aid of thin crystals (from  $\sim 1\mu$  up to some tens of microns). The dispersion of the diffraction-grating spectrograph used was 4 Å/mm and 1.7 Å/mm. Line splitting was found to depend on the polarization and on the direction of the magnetic field. A diamagnetic line shift was observed which is increasing with the magnetic field strength and with the quantum number (in the case of the hydrogen-like lines). The Zeeman splitting of the weak lines between 4889 and 4854 Å was not uniform for all lines studied. In a discussion of these results the authors show that  $\times$

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Magneto-optical effects in the...

an electric field acts on the exciton levels in a magnetic field. A. G. Samoylovich and L. A. Korenblit (DAN SSSR, 100, 43, 1955) studied the action of a Lorentz field on an exciton moving in a magnetic field. The results obtained here are explained as follows: The excitons of a CdS crystal have a dipole moment caused by the asymmetry of the intra-crystalline field. The axis of this dipole is directed along the optical axis  $\vec{A}$  of the crystal. If  $\vec{A} \perp \vec{H}$ , the electric Lorentz field is perpendicular to the dipole axis, and if  $\vec{A} \parallel \vec{H}$ , it is parallel to the dipole axis. In the first case, the Stark effect obviously reaches a minimum. In the second case, a Stark effect is observed on exciton levels of greater radii. The discovered diamagnetic shift of absorption lines confirms the existence of exciton series which are related to the complex band structure in a CdS crystal. The Zeeman effect proves the complex energy structure of an exciton in a CdS crystal. The appearance of a Lorentz field in magneto-optical exciton effects indicates the existence of a movable exciton system. There are 3 figures, 2 tables, and 12 references: 8 Soviet and 4 non-Soviet. The three most recent references to English-language publications read as follows: E. F. Gross, J. Phys. Chem. Sol., 9, 172, 1959; J. J. Jopfield and J. G. Thomas, Phys.

X

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Magneto-optical effects in the...

Rev. Sit., 1, 7, 1960; R. G. Wuler and J. O. Dimmok, Phys. Rev. Sit., 3,  
372, 1959.

ASSOCIATION: Fiziko-tehnicheskiy institut im. A. F. Ioffe AN SSSR  
Leningrad (Physicotechnical Institute imeni A. F. Ioffe,  
AS USSR, Leningrad)

SUBMITTED: May 17, 1961

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20799  
1/03/011/045/056

24.3600 (1035, 1144, 1385, 1147)

AUTHORS: Zakharchenya, B., Sibilev, A. I., Kanskaya, L. M., and Ryakin, A. Ya.

TITLE: Zeeman effect on  $B_1$  and  $B_2$  absorption lines of ruby in strong pulsed magnetic fields

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3531-3533

TEXT: Zeeman splitting of  $B_1$  and  $B_2$  absorption lines of ruby was achieved by applying pulsed magnetic fields of up to 15000 GKO ceraedts. The  $C_3$  principal axis of the ruby crystals was perpendicular to the direction of observation. It could be orientated perpendicular to, or in the direction of, the magnetic field  $H$ . In the diagram showing the results the distances between the components of the quartets are unequal, which is appropriate for the splitting of the principal level ( $d = 0.38 \text{ cm}^{-1}$ ) in the absence of magnetic field. The fact of such splitting is in good agreement with the paramagnetic resonance theory of S. Sugano

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Zeeman effect on  $B_1$  and  $B_2$  lines of ...

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... 01/03/01/011/045/056

01/03/1958

and Y. Tanabe (J. Phys. Soc. Japan, 13, 680, 1956). The asymmetrical intensity of the edge components of the line splitting does not agree with theory. The spectroscopic splitting factor of the excited level differs from the theoretical value by -0.10 for the  $B_2$  line and by about +0.30 for the  $B_1$  line. This indicates considerable theoretical error.

A later paper will discuss the experimental method used for this kind of investigation. Corresponding Member A.I. Luria (Dr. F. Gross is thanked for his interest. There are 1 figure and 3 tables. 1 Soviet and 2 non-Soviet. The two references to English-language publications read as follows: S. Sugano, Y. Tanabe, J. Phys. Soc. Japan, 13, 680, 1956; S. Sugano, J. Tsujikawa, J. Phys. Soc. Japan, 17, 899, 1958.

X

ASSOCIATION: Fiziko-tehnicheskiy institut im. A. F. Ioffe AN SSSR  
(Physicotechnical Institute im. A. F. Ioffe AS USSR,  
Leningrad)

SUBMITTED: July 10, 1960

Card 242

24,6200

26.2420

36881

S/181/62/004/004/025/042  
B102/B104

AUTHORS: Gross, Ye. F., Zakharchenya, B. P., and Sibilev, A. I.

TITLE: Zeeman effect of indirect excitons in Cu<sub>2</sub>O crystals

PERIODICAL: Fizika tverdogo tela, v. 4, no. 4, 1962, 1003-1008

TEXT: The Cu<sub>2</sub>O spectrum shows, apart from the hydrogen-like series, a continuous stepwise absorption; the first step begins at 6164 Å, the second at 6085 Å (T = 77.3°K). This stepwise absorption can be explained among others by the optical spectrum of polaron formation or indirect exciton transitions due to exciton interaction with monochromatic phonons ( $E_{ph} = 105 \text{ cm}^{-1}$ ). The latter model was proposed by R. J. Elliott (Proc. Internat. Conf. on Semicond. Phys. Prague, 408, 1960; Phys. Rev. 124, 340, 1961). It is in good agreement with the observed dependence of the absorption coefficient on the frequency of the light absorbed:  $k \sim (hv - E_0)^{1/2}$ ,  $E_0$  is the energy at the beginning of the step; it was checked by experiments of the effect of uniaxial deformation on the short-

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S/181/62/004/004/025/042  
B102/B104

Zeeman effect of indirect...

wave edge of the first absorption step (FTT, 2, 2968, 1960). A further check was made now when studying the Zeeman splitting of the absorption edge at 150 koe. The pulsed magnetic field (half-period 3  $\mu$ sec) was produced by a liquid-nitrogen cooled solenoid. The  $Cu_2O$  single crystals were cooled to 77.3°K and exposed to that field in parallel to the directions [100], [110], and [111]. The experimental conditions are given by

$$\begin{array}{lll} I \ H \parallel [100]; & q \parallel [100]; & \vec{\epsilon}(p) \parallel [100]; & \vec{\epsilon}(s) \parallel [100]; \\ II \ H \parallel [111]_{xy}; & q \parallel [110]_{xy}; & \vec{\epsilon}(p) \parallel [111]_{xy}; & \vec{\epsilon}(s) \parallel [112]_{xy}; \\ III \ H \parallel [110]_{xy}; & q \parallel [110]_{xy}; & \vec{\epsilon}(p) \parallel [110]_{xy}; & \vec{\epsilon}(s) \parallel [100]. \end{array}$$

The vectors  $\vec{q}$  and  $\vec{\epsilon}$  denote the directions of light propagation and its polarization. In all cases, the measurements were made for  $H \parallel H$  and  $E \perp H$ . With all orientations, the splitting of the quadrupole exciton line with  $n=1$  was observed, the total amount of the splitting was 4 Å. The center of gravity of the triplet was red-shifted and the triplet was asymmetric. Besides the quadrupole line also the edge at 6085 Å was split; number and position of components were dependent on the geometry of the experiment.

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S/181/62/004/C04/025/042  
B102/B104

Zeeman effect of indirect...

(Fig.). The results are analyzed in detail and it is found that, in agreement with Elliott's theory, the steps in the continuous absorption correspond to combined exciton-phonon transitions. The phonon involved has the symmetry  $\Gamma_{12}$ . The continuous exciton absorption in the range of indirect transitions is indicative of exciton energy bands connected with an exciton migration in the crystal. A. G. Zhilich is thanked for discussions. There is 1 figure.

ASSOCIATION: Fiziko-tehnicheskiy institut im. A. F. Ioffe AN SSSR  
Leningrad (Physicotechnical Institute imeni A. F. Ioffe  
AS USSR, Leningrad)

SUBMITTED: December 13, 1961

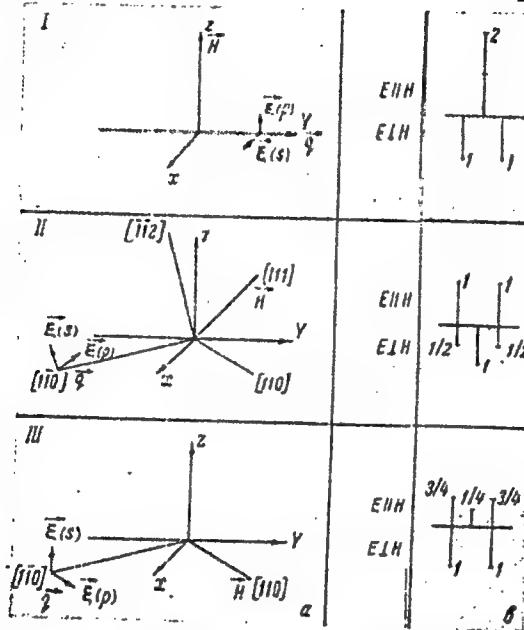
X

Card 3/4

Zeeman effect of indirect...

S/181/62/004/004/025/042  
B102/E104

Card 4/4



S/051/62/012/005/011/021  
E039/E120

AUTHORS: Zakharchenya, B.P., and Sibilyev, A.I.

TITLE: Magneto-optical investigation of crystals in  
strong pulsed magnetic fields. I.

PERIODICAL: Optika i spektroskopiya, v.12, no.5, 1962, 616-621

TEXT: An apparatus is described for the investigation of the Zeeman effect in the absorption spectra of crystals in strong pulsed magnetic fields. The pulsed magnetic field is created by discharging a bank of condensers (200 to 1000  $\mu$ F charged to 3 kV), through a liquid nitrogen cooled coil (inductance 1 to 2 milli-henry), capable of producing fields of up to 200 K oersted. The discharge is oscillatory and the first half cycle is used for experiments. Zeeman splitting is investigated by means of a monochromator and photomultiplier using a constant continuous spectrum source. Measurements were also made using photographic recording and a pulsed light source synchronized with one of the alternating magnetic field pulses. A typical microphotometer trace of a Zeeman split line  $n = 5$  for a crystal of  $Cu_2O$  is

Card 1/2

Magneto-optical investigation of ... S/051/62/012/005/011/021  
E039/E120

shown. The half width of this line is about 4 to 5 Å, for a field of 130 K oersted at a temperature of 77.3 °K and using apparatus with a dispersion of 4Å/mm. In a more powerful field the  $n = 2$  line is resolved with a half width  $> 10 \text{ \AA}$ .  
There are 5 figures.

SUBMITTED: March 21, 1961

Card 2/2

ZAKHARCHENYA, B. P.; RYISKIN, A. Ya.

Zeeman effect in the absorption spectrum and luminescence of  
CaF<sub>2</sub> - Sm<sup>++</sup> and SrF<sub>2</sub> - Sm<sup>++</sup> crystals. Opt. i spektr. 13 no.6:  
875-877 D '62. (MIRA 16:1)

(Magneto optics)  
(Calcium fluoride crystals—Spectra)  
(Strontium fluoride crystals—Spectra)

LLC15  
S/181/63/005/001/047/064  
B108/B180

247600

AUTHORS: Agekyan, V. T., Gross, Ye. F., Zakharchenya, B. P., and Kaplyanskiy, A. A.

TITLE: Piezomagneto-optical investigation of the quadrupole exciton transition in Cu<sub>2</sub>O crystals

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 315-317

TEXT: The effect of a magnetic field  $\vec{H}$  (30 koe) and a compression  $P$  perpendicular to  $\vec{H}$  upon the quadrupole exciton line  $n = 1$  (transition  $\Gamma_1^+ \rightarrow \Gamma_2^+$ ) in the Cu<sub>2</sub>O spectrum, was studied on a Cu<sub>2</sub>O single crystal compressed along the [001] axis. The spectrum was taken on a DFS-3 (DFS-3) spectrograph with linear dispersion 2 Å/mm. Observations were made in polarized light ( $E \parallel P$  and  $E \perp P$ ) perpendicularly to both  $\vec{H}$  and  $P$ . Without pressure, the  $n=1$  line ( $\lambda = 6125 \text{ Å}$ ) is split into a triplet with its central line (polarized  $E \parallel \vec{H}$ ) in the position of the old line. The other two (polarized  $E \perp \vec{H}$ ) have equal intensities and are symmetric about the central line. With rising pressure the central line shifts to longer . . .

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Piezomagneto-optical investigation ...

S/181/63/005/001/047/064  
B108/B180

waves, and the short-wave line to shorter waves with intensity increased at the expense of the long-wave line. Above  $2 \text{ kg/mm}^2$  the long-wave line vanishes, leaving the other two polarized with equal intensities. These results are in full agreement with results obtained by solving the secular equation for the splitting of the  $\text{P}_{25}^+$  level in the presence of an elastic deformation and a magnetic field (A. G. Zhilich. FTT, 3, 2041, 1961). There are 3 figures and 1 table.

ASSOCIATION: Fiziko-tehnicheskiy institut im. A. F. Ioffe AN SSSR,  
Leningrad (Physicotechnical Institute imeni A. F. Ioffe  
AS USSR, Leningrad); Leningradskiy gosudarstvennyy  
universitet (Leningrad State University)

SUBMITTED: August 14, 1962

Card 2/2

hh517

S/181/63/005/001/049/064  
B106/B180

44.760

AUTHORS: Gross, Ye. F., Zhilich, A. G., Zakharchenya, B. P.,  
Makarov, V. P., and Sibilev, A. I.

TITLE: Zeeman effect of the yellow exciton series in strong magnetic  
fields

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 327-338

TEXT: The Zeeman effect of the members of the yellow exciton series of  
directed Cu<sub>2</sub>O crystals was examined in magnetic fields of up to 140 koe

in the direction perpendicular to the magnetic field. The crystals were  
cooled in liquid helium. With increasing field strength the line splitting  
grows more complex with rising main quantum number n (Paschen-Bak effect).  
The experiments with single crystals showed clear dependence between the  
splitting and the orientation of the crystal in the magnetic field. The  
Zeeman splitting of the principal members of the yellow series with n > 2  
is distorted by the action of forbidden lines. Conclusions: In Cu<sub>2</sub>O there  
is a  $\Gamma_5^+$  zone at the top of the valency band and a  $\Gamma_1^+$  zone at the bottom

Card 1/2

Zeeman effect of the yellow exciton ...

S/181/63/005/001/049/061  
B108/B180

of the conduction band. If the former is assumed to be due chiefly to the 2p-state of the oxygen, one can neglect the spin-orbit interaction. If, however, the  $\Gamma_{25}^+$  valency band is mainly due to the 3d-state of Cu, the spin-orbit interaction will split it into a doubly degenerate  $\Gamma_7^+$  and a quadruply degenerate  $\Gamma_8^+$  band (at  $\vec{k} = 0$ ). These two band models are used to develop the theory of the Zeeman effect of directly forbidden excitons. Theory and experiment do not, however, fully agree. The  $\Gamma_{25}^-$ ,  $\Gamma_2^-$ ,  $\Gamma_{12}^-$  symmetry levels may affect the magnetic sublevels that are due to the splitting of the  $\Gamma_{15}^-$  level. There are 3 figures.

ASSOCIATION: Fiziko-tehnicheskiy institut im. A. F. Ioffe AN SSSR,  
Leningrad (Physicotechnical Institute imeni A. F. Ioffe  
AS USSR, Leningrad)

SUBMITTED: August 14, 1962

Card 2/2

ZAKHARCHENYA, B.P.; RYSKIN, A.Ya.

Magneto-optical phenomena in the absorption and emission  
spectra of  $\text{CaF}_2\text{-Eu}^{4+}$  crystals. Opt. i spektr. 14 no.2:309-311 F '63.  
(MIIA 16:5)

(Magneto-optics)

(Crystals—Spectra)

ACCESSION NR: AP4020956.

S/0051/84/014/003/3455/0460

AUTHOR: Zakharchenya,B.P.; Makarov,V.P.; Vafoldanayev,A.V.; Rytskin,A.Ya.

TITLE: Zeeman splitting of the principal emission line in  $\text{CaF}_2:\text{Th}^{2+}$  crystals

SOURCE: Optika i spektroscopiya, v.16, no.3, 1984, 455-460

TOPIC TAGS: Zeeman effect, Zeeman splitting, thulium doped calcium fluoride, thulium activated calcium fluoride, calcium fluoride, thulium<sup>2+</sup>, thulium ion, crystal structure, transition probability

ABSTRACT: Observation of the Zeeman effect in the spectra of crystals doped with transition-group ions can yield information on the symmetry of the states involved in the detected transitions, the multipole order of the transitions, and on the crystal structure and field. Zeeman splitting in the optical spectra of  $\text{CaF}_2:\text{RE}^3$  ( $\text{RE}$  = rare earth) crystals was first observed and investigated by V.A.Arkhangel'skaya and P.P.Feofilov (Optika i spet., 4, 602, 1958) and has subsequently been studied by other authors. The present work is devoted to investigation - experimental and theoretical - of Zeeman splitting of the intense 1.116- $\mu$  line of the divalent thulium ion in  $\text{CaF}_2$ . The associated transition is identified. The infrared

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ACC.NR: AP4020956

spectra were observed by means of a DFS-12 double monochromator in which the standard diffraction grating was replaced by a special grating with 600 lines/mm and which concentrated 76% of the light in the 0.8 to 2.5- $\mu$  region. The linear dispersion was 10 Å/mm. The radiation detector was a liquid-nitrogen-cooled FEU-22 photomultiplier. The field was produced by a magnet with 30-mm-diameter Permendur pole pieces and a gap of 20 mm; the highest field strength was 40-kOe. The CaF<sub>2</sub>:Tm<sup>3+</sup> single crystals were prepared by gamma-irradiation of CaF<sub>2</sub>:Tm<sup>3+</sup> crystals. The specimens were cooled to 77 and 4.2°K. The splitting in the 40 kOe field varies in the range from under 3 to over 9 cm<sup>-1</sup>, depending on the orientation of the magnetic field, the direction of observation, and the orientation of the electric vector of the light. The components of the doublet are not always equal. The results are analyzed from the theoretical standpoint. An attempt made to observe the splitting of the second intense line at 1.189  $\mu$  proved vain for reasons that are still obscure. "The authors acknowledge their gratitude to Ye.F.Gross for his interest in the work and to P.P.Peofilov for useful suggestions." Orig.art.has: 25 formulas and 3 figures.

2/3  
Card

ACCESSION NR: AP4043009

S/0051/64/017/002/0219/0229

AUTHORS: Zakharchenya, B. P.; Makarov, V. P.; Ry\*skin, A. Ya.

TITLE: Zeeman effect for f-d transitions in the spectra of rare earth fluoride crystals activated with  $\text{Sm}^{2+}$

SOURCE: Optika i spektroskopiya, v. 17, no. 2, 1964, 219-229

TOPIC TAGS: Zeeman effect, absorption spectrum, emission spectrum, rare earth compound, fluoride, samarium, group theory

ABSTRACT: This is a continuation of earlier investigations (B. P. Zakharchenya and A. Ya. Ry\*skin, Opt. i spektr. v. 13, 675, 1962 and v. 14, 309, 1963), and contains additional experimental facts and a more thorough theoretical discussion. The article reports on the results of experimental and theoretical investigation of the Zeeman effect of the most intense emission lines in crystals of the type  $\text{MeF}_2\text{-Sm}^{2+}$  (where Me = Ca, Sr, or Ba) and of the narrow absorp-

1/3

ACCESSION NR: AP4043009

tion lines in  $\text{CaF}_2\text{-Sm}^{2+}$  and  $\text{SrF}_2\text{-Sm}^{2+}$ . The experiments were performed with single crystals  $\text{MeF}_2\text{-Sm}^{2+}$  containing a variable amount of  $\text{Sm}^{2+}$ , up to 0.5%, with the crystals cut in such a way as to permit their orientation in a magnetic field parallel to the four-fold, three-fold, or two-fold axis. The observation was made in polarized light in a direction perpendicular to the magnetic field, with the crystals cooled with liquid helium. The experimental data were analyzed on the basis of group-theoretical representations for the f-d transitions in the crystal. Two approximations were used in the calculation of the states of the  $f^5d$  configuration.

In one the interaction of the  $f^5$  electrons with the crystal field is assumed stronger than their interaction with the d-electron, and the other the interaction of the d-electron with the  $f^5$  core is assumed stronger than the interaction of the  $f^5$  electron with the field. The second approximation agrees better with the experimental data. "The authors are grateful to Ye. F. Gross and P. P. Feofilov

2/3

ACCESSION NR: AP4043009

for interest in the work, and also to A. G. Zhilich for many useful consultations on questions connected with the group-theoretical calculations." Crig. art. has: 4 figures, 7 formulas, and 2 tables.

ASSOCIATION: None

SUBMITTED: 29Jul63

SUB CODE: OP

NR REF Sov: 007

ENCL: 00

OTHER: 009

3/3

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b. Date of birth  
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APPROVED FOR RELEASE: 03/15/2001

CIA-RDP86-00513R001963510014-1"

L 12000-66 EMT(1)

ACC NR: AF5022860

SOURCE CODE: UR/0051/65/019/003/0365/0377

AUTHOR: Zakharcherya, B. P.; Rusanov, I. B.

ORG: none

TITLE: Group-theoretical analysis of the Zeeman effect in the optical spectra of cubic crystals

SOURCE: Optika i spektroskopiya, v. 19, no. 3, 1965, 365-377

TOPIC TAGS: group theory, Zeeman effect, cubic crystal, optic spectrum, crystal lattice symmetry, dipole moment, exciton, light polarization

ABSTRACT: The authors consider the general relationships governing the Zeeman effect

"...from which it follows that the Zeeman effect in the optical spectra of cubic crystals can be analyzed by the methods of group statistics in the simplest case (K<sub>3</sub>, Li, Be, ..., or H<sub>3</sub>O<sup>+</sup>). It is shown that in the majority of cases the relative intensities of the Zeeman components can be found knowing only the basis functions of the appropriate irreducible representations, so that only the transformation properties of the electric dipole moment operator and the transformation properties of the wave functions describing the appropriate Zeeman sublevels are ne-

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UDC: 539.184.28 : 548.0

L 12000-66

ACC NR: AP5022860

field and excitons in cubic crystals, if the exciton transitions occur at points of the exciton bands with  $k = 0$ . It is shown that the most interesting case in the study of the Zeeman effect is that in which  $H_0 \parallel [111]$ , for when the direction of observation for this orientation is parallel to the field the Zeeman components can in many cases have not only circular but elliptical and even linear polarization. The results are found to be in satisfactory agreement with experimental data, but are applicable only when the distances between the Zeeman sublevels are less than the original splitting of the electronic states in the crystal. They can be extended to obtain the rules for the Zeeman effect of quadrupole transitions in cubic crystals. Authors thank A. A. Kaspivanskiy for valuable advice, V. P. Zhdanov for interest in the work, and A. I. Zhilich and V. P. Makarov for helpful consultations. Orig. art. has 6 formulas and 5 tables.

SUB CODE: 20 / RMB DATE: 18Jun64 / OMS REF: 008/ OTM REF: 012

Cord 2/2

ACC NR: AR00-3152

Page 2008 - 1P/0181/66 - 08/061/0041/0044

AUTHOR: Zakharkhina, N. P.; Kusaroy, L. B.  
Institute: Institut po fizicheskym problemam radiofiziki i radiochimii SSSR, Lebedinsk (Filialko-  
technicheskiy Institut AN SSSR)  
Title: On the centers of purely cubic centers in the CaF-Eu<sup>3+</sup>

TEKHNIChESkiy INSTITUT AN SSSR  
TITLE: Experimental proof of the existence of purely cubic centers in the CaF<sub>2</sub>-Eu<sup>3+</sup>  
crystal // 8-10-1960, 41-44

crystal SOURCE: Fizika tverdogo tela, v. 8, no. 1, 1966, 41-44  
line splitting. Fluorite, acti-

SOURCE: Fizika vysokich frekvencii  
TOPIC TAGS: Zeeman effect, absorption spectrum, line splitting, fluorite, activated crystal, europium, cubic crystal, absorption line, magnetic field

**ABSTRACT:** The authors investigated the Kraman effect on the absorption lines in the spectra of  $\text{CaF}_2\text{-Eu}^{3+}$  crystals, grown in the P. N. Lebedev Physics Institute by the method of slow evaporation (VPT-1, No. 1, 1965). The absorption spectra of such

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ACC RR: AF5003159

ACROSS: ABSORPTION. The mean splitting was found to be proportional to the magnetic field.

APT. 12A FIGURE.

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APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001963510014-1"

ACCE-NMF AT6034035

SOURCE CODE: U2/0000/66/001/000/0126/0130

AUTHORS: Zakharcherya, B. P.; Rusanov, I. B.; Fyskin, A. Ya.

ORG: none

TITLE: Magneto-optic effects in the spectrum of a  $\text{CaF}_2\text{-Eu}^{2+}$  crystal

SOURCE: Simpozium po spektroskopii kristallov, soderzhashchikh redkozemel'nyye elementy i elementy gruppy zheleza. Moscow, 1965. Spektroskopiya kristallov (Spectroscopy of crystals); materialy simpozium. Moscow, Izd-vo Nauka, 1966, 126-130

TOPIC TAGS: magneto optic effect, Zeeman effect, electron paramagnetic resonance, Hamiltonian

ABSTRACT: Splitting of the resonance line for  $\text{CaF}_2\text{-Eu}^{2+}$  was studied in both absorption and emission spectra. When the magnetic field was parallel to the fourth-order axis ( $H_0$  parallel to  $\langle 001 \rangle$ ), the spectrogram plainly revealed asymmetry in intensity of the Zeeman component relative to the line not affected by the field. This asymmetry is clearly due to thermal freezing of the ions in strong magnetic fields. At low temperatures this occurs on Zeeman sublevels of the ground and excited states. From the experimental data on Zeeman splitting of  $\lambda_0 4130 \text{ \AA}$  with different crystal orientations in the magnetic field, it is established that the behavior of the excited level is defined by a spin Hamiltonian of the type

$$\mathcal{H} = g\beta HS + J\beta IS ,$$

Card 1/2

ACC NR: AT6034035\*

where  $g$  and  $\beta$  are parameters determined from experiment and are related to the Lande splitting factor. It was found that  $|g| = 3.9 \pm 0.1$  and  $|f| = 2.4 \pm 0.1$ , and that the two are of opposite signs. Tentative theoretical considerations do not agree with this result, but the authors do not consider this too serious since the premises for the theory of interaction between mixed configurations and the crystalline field are highly speculative. This scheme permits examination of a number of possibilities in optical detection of electron paramagnetic resonance in  $\text{CaF}_2\text{-Eu}^{2+}$ . Detection of resonance may be due to selective reabsorption of the Zeeman component of emission. It may also be due to competition in intensities of resonance Zeeman transitions in absorption and emission. Orig. art. has: 4 figures and 1 equation.

SUB CODE: 20/ SUBM DATE: 25May66

Card 2/2

L 31501-66 ENT(1)  
ACC NR: AP6013032

SOURCE CODE: UR/C051/66/C20/C04/0730/0732

AUTHOR: Zakharchenya, B. P.; Kreytser, V. L.; Kanakaya, L. M.; Sibilev, A. I.; Pekny, L. A.

ORG: none

TITLE: Use of an electron optical converter of light for the study of magneto-optical phenomena in crystals in strong pulsed magnetic fields

SOURCE: Optika i spektroskopiya, v. 20, no. 4, 1966, 730-732

TOPIC TAGS: electrooptic image intensifier, magnetooptic effect, Zeeman effect, absorption spectrum, light absorption, PULSED MAGNETIC FIELD

ABSTRACT: Earlier experiments by two of the authors (Zakharchenya and Sibilev, Opt. i spektr. v. 12, 616, 1962), in which strong pulsed magnetic fields were used to investigate the Zeeman effect on absorption lines in optical spectra of crystals, are repeated using an electron-optical converter and a time-sweep technique. In these experiments, the image of a narrow part of the spectrum, containing one line or a group of lines was produced in the focal plane of a spectrograph with diffraction grating (dispersion 4 Å/mm) and projected on an electron-optical converter with a cylindrical lens. The time sweep of the spectrum was produced by

UDC: 539.184.28: 5480.

Card 1/2

L 31501-66

ACC NR: AP6013032

applying a paraphase sawtooth voltage on one pair of deflecting plates. The Zeeman splitting was observed on the oscilloscope screen and could be photographed from the latter. The tests demonstrated the feasibility of the method, although the spectra investigated so far and the use of a low-transmission spectrograph gave little information on the eventual resolution attainable by the method.  
Orig. art. has: 2 figures and 1 formula.

SUB CODE: 20/ SUBM DATE: 27May65/ ORIG REF: 011/ OTH REF: 003

Card 2/2 mc

ACC NR: AP7005850

SOURCE CODE: UR/0181/66/008/012/3602/3605

AUTHOR: Zakharchenya, R. P.; Rusanov, I. B.; Tekhistova, I. I.

ORG: Physicotechnical Institute im. A. F. Ioffe, AN SSSR, Leningrad (Fiziko-tehnicheskiy institut AN SSSR)

TITLE: Magneto optics of "tetragonal centers" in  $\text{CaF}_2:\text{Eu}^{3+}$  crystals

SOURCE: Fizika tverdogo tela, v. 8, no. 12, 1966, 3602-3605

TOPIC TAGS: laser material, calcium fluoride, activated crystal, europium, magneto-optics, luminescence center, Zeeman effect, magnetic dipole, optic transition, *impurity center lattice defect*

ABSTRACT: This is a continuation of earlier work (FTT v. 8, 41, 1966) where experimental proof was presented for the existence of centers of purely cubic symmetry in  $\text{CaF}_2:\text{Eu}^{3+}$  crystals. In the present article, centers of various symmetries (cubic, tetragonal, rhombic), which occur following a heterovalent substitution of the  $\text{Eu}^{3+}$  ion for the cation, are related to the Zeeman splitting of the emission and absorption lines in the observed spectrum of  $\text{CaF}_2:\text{Eu}^{3+}$ . The tests were made on crystals grown at the Physics Institute im. P. N. Lebedev AN SSSR by a method described elsewhere (FTT v. 7, 267, 1965). No cubic lines were observed in the groups of emission of those lines connected with the transition between the  $\text{Eu}^{3+}$  states. The "tetragonal" spectrum was separated but its Zeeman components did not agree well with the theoretical approximations. No trigonal centers were observed in a crystal grown in a fluorine atmosphere, thus indicating again that these centers are connected exclusively with oxygen

Card 1/2

UDC: none

ACC NR: AP7005850

ions in the lattice. The experimentally observed laws governing the Zeeman splitting of the "tetragonal lines" are described. A theoretical analysis of these laws makes it possible to relate the indicated lines to the magnetic-dipole transitions ( $^1\Gamma_1 \rightarrow ^2\Gamma_3$ ) in the  $C_{4v}$  field. A study of the concentration dependence of the line intensity leads to the hypothesis that the excess charges at centers of different symmetry can be compensated by the same lattice defect with two negative charges. Further study of the model wherein one defect "serves" two  $TR^{3+}$  ions calls for further experiments. Orig. art. has: 3 figures and 2 formulas. [WA-14] [02]

SUB CODE: 20/ SUBM DATE: 28May66/ ORIG REF: 004/ OTH REF: 001

Card 2/2

ZAKHARCHISHINA, V.A.

Changes in the nucleic acid and vitamin C content of grafted  
Solanaceae and their seed generations during ontogenesis.  
Fisiol.rast. 7 no.1;67-72 '60, (MIRA 13:5)

1. Department of Plant Physiology of Scientific Research  
Biological Institute, A.M.Gorky, Kharkov State University.  
(Nucleic acid) (Ascorbic acid) (Eggplant) (Tomatoes)

front of the palate. In the second set, tied intervertical grafts, numbered 10000, were taken from (I), and intergenetic grafts, numbered 10001, from (II) and 10002 from (III). The results showed that changes occurred after one

ZAKHARCHISHINA, V.A.

Biochemical changes in grafted solanaceous plants and their seed  
progeny in repeated vegetative hybridization. Uch.zap.KHOU 46:69-81  
'53. (MIRA 11:11)  
(Nightshade) (Grafting) (Plants--Metabolism)

VOLKOVA, N.S.; ZAKHARCHISHINA, V.A.

Morphological changes in grafted solanaceous plants and their seed progeny in repeated vegetative hybridization. Uch.zap.KhGU "6:83-95 '53. (MIRA 11:11)

1. Kafedra darvinizma i genetiki Khar'kovskogo gosudarstvennogo universiteta.  
(Nightshade) (Grafting) (Botany--Morphology)

ZELENIN, A.N., doktor tekhn. nauk; ROVINSKIY, M.I., kand. tekhn. nauk;  
ZAKHARCHUK, B.Z., inzh.; TELJSHKIN, V.D., inzh.

Investigating the loosening of limestone. Gor. zhur, no.5:12-14  
My '65. | (MIRA 19:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut stroitel'nogo i  
dorozhnogo mashinostroyeniya, Moskva.

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ZAKHARCHUK, B.Z., inzh.; SIRENKO, V.N., inzh.; TELUSHKIN, V.D., inzh.;  
YAKOBASHVILI, O.P., inzh.

Seismic method of determining the solidity of limestone. Stroi. mat.  
11 no.6:5-6 Je '65. (MIRA 18:7)

SOV/68-59-8-25/32

AUTHOR: Zakharchuk, I.A.

TITLE: Redesign of an Electrostatic Precipitator of the  
S-140 Type (Rekonstruktsiya elekrofil'trov tipa C-140)

PERIODICAL: Koks i khimiya, 1959, Nr 8, pp 54-55 (USSR)

ABSTRACT: The redesign of an electrostatic precipitator of the  
above type is described. The main change was the  
replacement of insulating boxes and method of their  
heating. There is 1 figure.

ASSOCIATION: Gorlovskiy koksokhimicheskiy zavod  
(Gorlovka Coking Works)

Card 1/1

~~ZAKHARCHUK, L.I.~~, kand.med.nauk

Treatment of chronic coronary insufficiency with anticoagulants.  
Vrach. delo no. 1:30-32 '61. (MIRA 14:4)

1. Kafedra fakul'tetskoy terapii (zav. - dotsent S.M. Martynov)  
pediatricheskogo i sanitarno-gigiyonicheskogo fakul'tetov L'vovskogo  
meditsinskogo instituta.  
(CORONARY VESSELS—DISEASES)  
(ANTICOAGULANTS (MEDICINE))

ZAKHARCHUK, L.I., kand.med.nauk

Clinical evaluation of the suppressed respiration test as a method  
of diagnosing coronary insufficiency. Nauch.trudy L'vov.otl.terap.  
ob-va no.1:157-160 '61. (MIRA 16:5)

1. Kafedra fakul'tetskoy terapii pediatriceskogo i sanitarno-  
gigiychnicheskogo fakul'tetov L'vovskogo meditsinskogo instituta  
(zav. kafedroy - dotsent S.M. Marynov).  
(CORONARY HEART DISEASE) (RESPIRATION)

ZAKHARCHUK, L.I., kand.med.nauk

Paper electrophoresis of blood protein fractions in acute coronary insufficiency. Nauch.trudy L'vov.ohl.terap.ob-va no.11161-164 '61.

1. Kafedra fakul'tetskoy terapii pediatriceskogo i sanitarno-gigiyenicheskogo fakul'tetov L'vovskogo meditsinskogo instituta  
(zav. kafedroy - dotsent S.M. Martynov).  
(BLOOD PROTEINS) (CORONARY HEART DISEASE)

ZAKHARCHUK, M., instruktor; TITOV, V., instruktor

Methods for training submarine swimmers. Voen.znan. 37 no.7:31  
Jl '61. (MIRA 14:6)

1. Morskoy klub podvodnogo sporta Vsesoyuznogo dobrovol'nogo  
obshchestva armii, aviatii i flota, g. Alushta, Krymskoy oblasti.  
(Diving, Submarine)

KLIN, V.B., kand. tekhn. nauk; ZAKHARCHUK, N.I., insh.

Values of friction coefficients for some nonmetallic materials.  
Mashinostroenie no.3:109-110 My-Je '63. (MIRA 16:7)

1. Ukrainskiy institut inzhenerov vodnogo khozyaystva,  
g. Rovno.  
(Nonmetallic materials)

ORZHEROVSKIY, M.; ZAKHARCHUK, O.; ZAGORUIKO, V., inzh.-konstruktor

Electrochemical salt removal from sea water. Mor. flot 20 no.9:24-  
26 S '60. (MIRA 13:10)

1. Nachal'nik basseynovoy laboratorii Chernomorskogo parokhodstva  
(for Orzherovskiy). 2. Starshiy inzhener-konstruktor konstruktor-  
skogo byuro Chernomorskogo parokhodstva (for Zakharchuk). 3. Konstruk-  
torskoye byuro Chernomorskogo parokhodstva (for Zagoruko),  
(Sea water) (Electrochemistry)

ZAKHARCHUK, P.V., kand.sel'skokhosyaystvennykh nauk, dots.

The soils of Polesye. Nauka i zhyttia 8 no.10:34-37 '58.  
(MIRA 13:4)

(Polesye--Soils)

ZAKHARCHUK, P.V.; MATKARIMOV, U.

Reserves, distribution, and mobility of potassium in Sierozem soils  
of the Uzbek S.S.R. Pochvovedenie no.4:31-39 Ap '62.  
(MIRA 15:4)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk.  
(Uzbekistan--Sierozem soils) (Soils--Potassium content)

ZAKHARCHUK, S.M.

Facies of the Tournai stage of the Ivov Trough. Trudy Ukr-NICRI  
no.5:233-239 '63. (MIRA 18:3)

BEGAYETS, A.T.; ZAKHAROV, S.M.; KURYLO, G.P.; PLAKHOTNYY, I.S.;  
TRONCA, V.D.

Relation of structural plans of Neogene, Paleogene, and Upper  
Cretaceous sediments on Tarkhankut Cape. Geol. nefti i gaza 9  
no.6:12-16 Je '65. (AIIA 18:8)

A. Ukrainskiy nauchno-issledovatel'skiy geologorazvedochnyy in-  
stitut, Kiев, i Krymneftegazrazvedka.

ZAKHARCHUK, S.S.

Collective farm maternity hospitals in Ivov Province, Sov.zdrav,  
16 no.34-38 Ag '57. (MLRA 10:10)

1. Iz Ivovskogo oblastnogo otdela zdravookhraneniya (zav. V.P.  
Perileychenko)  
(HOSPITALS  
maternity, in rural areas in Russia)

ZAKHARCHUK, S.S. (L'vov)

Stopping atonic hemorrhages during early puerperium. Feild. i  
akush. 22 no.5:14-16 My '57. (MLRA 10:6)  
(HEMORRHAGE, UTERINE)

ZAKHARCHUK, S.S.

Obstetrical care in Lvov Province villages. Akush. i gin. 33 no.4:  
7-10 Jl-Ag '57. (MIRA 10:11)

1. Iz kafedry akusherstva i ginekologii (zav. - prof. A.V. Vilkov)  
kafedry organizatsii zdravookhraneniya (zav. - dotsent S.Z. Tkschenko)  
Lvovskogo meditsinskogo instituta i Lvovskogo oblastnogo otdela  
zdravookhraneniya (zav. V.D. Danileychenko)  
(OBSTETRALS  
in Russia)

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Zakharchuk SS

ZAKHARCHUK S. S. - inspektor rodovspomosheniya oblastnogo zdrevotdela  
(Lvov)

Prenatal care of pregnant women in rural areas. Fel'd. i skush.  
23 no.1:33-35 Ja '58. (MIRA 11:3)  
(PRENATAL CARE)

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ZAKHARCHUK, S.S. (Lvov)

History of the development of the first state midwife school in Lvov.  
Fol'd. i akush. 26 no. 2:39-41 F '61. (MIRA 14:4)  
(LVOV—OBSTETRICS—STUDY AND TEACHING)

ORZHEVSKIY, M., insh.; ZAKHARCHUK, O., insh.; ZAGORUYKO, V., insh.

First marine unit for electrochemical distillation of sea water.  
Mor.flot 19 no.6:28-30 Je '59. (MTRA 12:9)

1. Chernomorskoye parokhodstvo.  
(Sea water, Distillation of) (Ships--Equipment and supplies)

ZAKHARCHUK, O.  
ZAKHARCHUK, O.

~~Rotary scavenger pump for two-cycle engines. Mor.flot 17 no.10:28-29  
O '57.~~  
Rotary scavenger pump for two-cycle engines. Mor.flot 17 no.10:28-29  
(MIRA 10:12)  
O '57.

1. Starshiy inzhener proyektno-konstruktorskogo byuro Chernomorskogo  
parokhodstva.  
(Marine diesel engines)

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Chemical Abstracts

May 15, 1954

Soils and Fertilizers

A new universal method of determining the exchange capacity of soils. P. V. Zikharevskii Inst. Agr. Kres. Pochvovedenie 1953, No. 7, 65-8. Soils free of carbonates are treated with 0.05N HCl and then with Ca acetate. The amt. of Ca used is detd by titrating the acidic part of the leachings. Another titration with the H salt is done, washed with H<sub>2</sub>O and the end titrated. The difference in the two titrations give the cation exchange capacity. In soils with carbonates 0.1N w. HCl is used until no CO<sub>2</sub> is given off. This is followed by the 0.05N HCl and the procedure as given for soils free of carbonates.

ZAKHARCHUK, P. V.

VLASYUK, P.; ZAKHARCHUK, P.; KALYUZHNYI, V.; PERESYPKIN, V.

Seventieth birthday of Mikhail Mikhailovich Godlin. *Pochvovedenie*  
no.3:117-118 Kr '57. (MLBA 10:7)  
(Godlin, Mikhail Mikhailovich, 1886-)

ZAKHARCHUK, S.

Use of the "Flekais" machine for drying carpenter's glue.  
Mias. ind. SSSR 32 no. 3:48 '61. (MIR 14:7)

1. Nikolayevskiy myasokombinat.  
(Nikolayev—Glue)

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CIA-RDP86-00513R001963510014-1

ZAKHARCHUK, S.S.; RUDOVA, A.I. (Lvov)

Etiology, prophylaxis, and treatment of epidemic pemphigus of the  
newborn. Fel'd. i akush. 24 no.10:30-33 0 '59. (MIRA 13:2)  
(PEMPHIGUS)

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CIA-RDP86-00513R001963510014-1"

ZAKHARCHUK, S.S.

Fundamental problems of congenital toxoplasmosis and tasks  
for their further study. Med. paraz. i paraz. bol. 24 no. 5:  
597-601 S-0 '65 (MIFA 1961)

1. L'vovskiy nauchno-issledovatel'skiy institut zdravny  
materinntva i detstva. Submitted July 9, 1964.

ZAKPARCHUK, S.S., kand.med. nauk

Some data on the detection and treatment of toxoplasmosis in  
pregnant women. Skush. i gin. 39 no.3:52-57 Ky-Je '63  
(MIRA 17:2)

1. Iz L'vovskogo nauchno-issledovatel'skogo instituta okhreny  
materinstva i detstva (direktor - kand. med. nauk L.Ya. Davydov).

ZAKHARCHUK, S.S., kand. med. nauk

Diagnosis and treatment of toxoplasmosis in pregnancy terminating in premature birth. Pediat. akush. ginek. no.3:37-38 '63  
(MIRA 17:1)

1. L'vovskiy nauchno-issledovatel'skiy institut okhrany materninstva i detstva ( direktor - kand. med. nauk. L.Ya.Davidov)  
[Davydov, L.IA.]

ZAKHARCHUK, S.S., kand.med.nauk (L'vov)

Intracutaneous test with toxoplasmin. Pel'd. i slush. 28 no.4:  
25-26 Ap'63. (MIDU 16:8)

1. Iz Nauchno-issledovatel'skogo instituta okhrany materinstva  
i detstva.  
(TOXOPLASMOSIS)

ZAKHARCHUK, S.S., kand.med.nauk (L'vov)

Our experience in organizing health education work among parturients  
for the prevention of premature births. Fel'd. Akush. 26 no.4:  
48-49 Ap '61. (MIRA 14:3)  
(PREGNANCY, COMPLICATIONS OF)

ZAKHARCHUK, S.S. (L'vov)

History of obstetrics in the western provinces of the Ukraine before  
and after their incorporation into the Ukrainian S.S.R. Sov. zdrav.  
19 no.6:66-68 '60. (MKRA 13:9)

1. Iz L'vovskogo nauchno-issledovatel'skogo instituta okhrany  
materinstva i detstva (dir. - kandidat meditsinskikh nauk L.Ya.  
Davydov).

(UKRAINE, WESTERN—OBSTETRICS)

ZAKHARCHUK, S.S.

- Short sketch on the development of obstetrical services in Lvov and  
Lvov Province. Ped., akush. i gin. 19 no.4:61-62 '57. (MIRA 13:1)
1. Kafedra akusherstva i ginekologii (zav. - prof. A.V. Vitulov) i  
kafedra organizatsii okhrany zdrorv'ya (zav. - dots. S.Z. Tkachenko)  
L'vovskogo meditsinskogo instituta.  
(LVOV PROVINCE--OBSTETRICS)

ZAKHARCHUK, S. S.: Master Med Sci (diss) -- "Obstetric aid in the western oblasts of the Ukraine before and after their unification with the Ukrainian SSR". L'vov, 1959. 15 pp (L'vov State Med Inst), 200 copies (KL, No 18, 1959, 128)

ERYUSHCHENKO, L.P.; ZAKHARCHUK, V.I.

Rhythmic work is the guarantee of high technical and economic  
indices. Ugol' '69 no.5:16-18 My '64. (MIRA 17:8)

1. Normativno-issledovatel'skaya stantsiya tresta Petrokegol'.

З.І. РЕДАКЦІЯ ГУРМАНІСТІВ  
КЕВДІН, Н. А. ЗАХАРЧУК, В. Н.

Rectal novocain therapy of hypertension. Klin. med., Moskva  
30 no.4:82 Apr. 1952, (CLML 22:2)

1. Honored Worker in Science, Professor for Kevdin. 2. Of the  
Clinic of Faculty Therapy (Head -- Prof. N. A. Kevdin), L'vov  
Medical Institute.

KEVDIN, N.A., professor, zasluzhennyy deyatel' nauki; ZUBOVA, R.F.; ZAKHARCHUK, V.N.

Drug-induced sleep therapy of hypertension. Klin.med. 32 no.9:62-70  
S '54. (MLB 7:12)

1. Iz kafedry fakul'tetskoy terapii (zav. prof. N.A.Kevdin) L'vovskogo  
meditsinskogo instituta.  
(HYPERTENSION, therapy,  
sleep)  
(SLEEP, therapeutic use,  
hypertension)

YERMAK, D., inzh.; ZAKHARCHUK, V., inzh.

The redesigned mines of the Donets Basin should have small-scale buildings. From.stroi.i inzh.soor. 4 no.1:23-27 Ja.-F '62.  
(MIRA 15:8)

(Donets Basin--Mine buildings)

ZAKHARCHUK, Zakhr Ivanovich; MASICH, Vladimir Ivanovich; VATOLIN, G.N.,  
vedushchiy red.; VORONOVA, V.V., tekhn. red.

[Packers and anchors; design and use] Pakery i iakori, konstruktsii  
i oblasti primenenia. Moskva, Gos.nauchno-tekhn.izd-vc neft.i gorno-  
toplivnoi lit-ry, 1961. 78 p. (MIRA 14:12)  
(Oil wells—Equipment and supplies)

ZAKHARENKO, A. [Zakharenka, Aliaksandra]

We like our "university". Rab. i sial. 35 no.11:3-4 N '59.  
(MIRA 13:3)  
(Gomel'--Amateur art activities)  
(Acting--Study and teaching)

ZAKHARENKO, A. [Zakharenko, A.] (Gomel')

Successors. Rab.1 sial. 36 no.6:4-5 Je '60. (MIRA 13:7)  
(Gomel'--Railroads--Stations)

BUDOVICH, B.; GAMBURG, R.; ZAKHARENKO, A.; NADEZHDINA, K., obshcheschestvennitsa—  
pensionerka; NOWIK, L.; PIGUZOVA, N.; SMIRNOVA, I.; FOMITSKAYA, T.;  
deputat Minskogo gorodskogo Soveta; BURMISTROVA, L.

Place nurseries and kindergartens under the control of women, Rabotnitsa.  
4G no.7:18-19 J1 '62. (MIRA 16:2)

1. Predsedatel' zhenskogo soveta stankostroitel'nogo zavoda imeni  
Oktyabr'skoy revolyutsii (for Budovich). 2. Predsedatel' zhenskogo  
soveta gomeel'skoy fabriki "Komintern" (for Gamburg). 3. Korrespondent  
gazety "Gomel'skaya pravda" (for Zaharenko). 4. Korrespondenty  
zhurnala "Rabotnitsa i syalyanka" (for Piguzova, Smirnova). 5. Korres-  
pondent zhurnala "Rabotnitsa" (for Burmistrova).

(White Russia—Nursery schools) (White Russia—Kindergartens)

ZAKHARENKO, A. [Zakharanka, A.]

Trial by fire. Rab.i sial. 38 no.11:14-15 N '62.

(MIRA 15:11)

(Khoyniki District--World War, 1939-1945--Underground  
movements)

ZAKHARENKO, A. [Zakharenko, A.]

Progressive workers. Rab. i sial. 35 no.2:9-10 F '59.  
(MIRA 12:4)  
(Gomel'--Woodworking industries)

ZAKHARENKO, A. D.

The work methods of progressive stations Moskva, Gos. transp. zhel-dor. izd-vo,  
1945. 50 p. 49-56763

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